

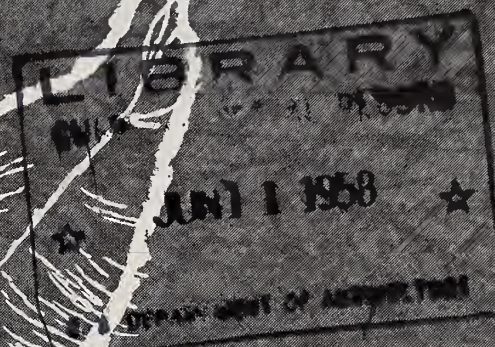
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AGRICULTURAL Research

MAY/1958



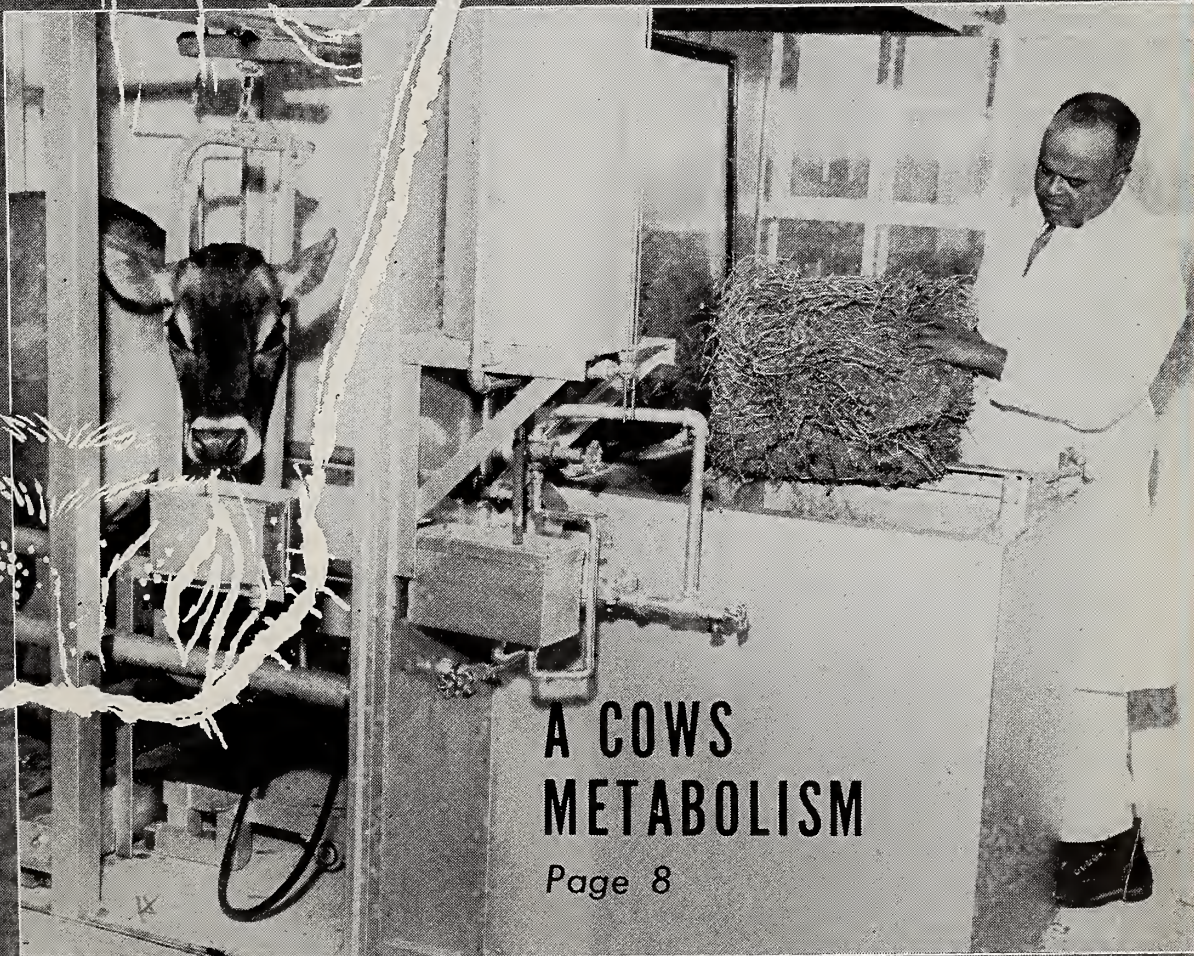
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Interdependence

A farmer has a piece of land. On it he grows some plants, then adds some animals. In producing from this land, he's actively challenging the complexity of Nature itself.

He faces hundreds of questions. Some are biological, as with a disease. Some are physical, as with soil water.

No farmer can answer all these questions for himself. Yet, as an individual, he must work out plans for running his farm. He needs the help of advisers and, in turn, scientists.

Agricultural research faces the complexity of Nature with a unique association of scientists trained in various biological and physical disciplines. It takes more than one of these scientists to answer many of the farmer's questions.

This has long been true, of course. The method for measuring pH of a soil resulted from years of basic research in several disciplines. Nernst, a physical chemist, provided the basis of the hydrogen electrode method. Sorensen, a biologist, supplied the pH symbol. Haber and Klemenziwicz, physicists, demonstrated the chemical nature of Helmholtz's glass electrode. There were many other contributions, including the vacuum tubes of de Forest, an electrical engineer.

This interdependence is even more needed today. As scientists build up more and more knowledge of Nature, research becomes more and more complicated. Nowadays, instead of an individual researcher, we have a group of scientists from many disciplines working together on a question.

Obviously, it's necessary that these scientists learn to "talk" to each other. They must have the drive and courage to venture outside the security of their own disciplines—to find out enough about the other disciplines to communicate with their colleagues. This calls for capable men and women who will also make the effort to keep up in their own fields.

And thought must be given to helping these scientists keep abreast of new developments in other research agencies and other countries. Our workers need the best in publications, libraries, and translation and abstracting facilities.

Agricultural research, with its many interrelated groups, must have good communications in order to find answers.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

*Nutritious feed from a
processing waste . . .*

APPLE POMACE

HEIFERS at Front Royal Beef Cattle Research Station (left) thrived on wet apple pomace, gaining better and faster than the animals eating locally grown feedstuffs.

PRESSED pomace or press cake, as it's called (below), shows the typical grainy structure. Cake is picked apart for easy eating.

PEELS, cores, stems, whole apples move on conveyor (above) from canning areas into chopper, to be finely chopped and put in wooden vats. Material is then pressed.

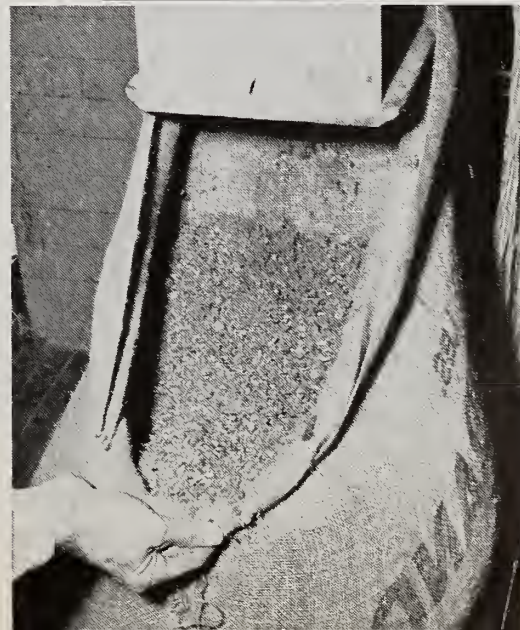


■ BEEF ANIMALS MAY NOT NEED an apple a day to keep healthy. But beef heifers on test recently put on weight when they ate pressed apple cores, stems, and peelings as an experimental winter roughage.

Cooperative research by the Virginia Agricultural Experiment Station and USDA's Beef Cattle Research Station at Front Royal, Va., showed that the pomace—as the apple leftovers are called—is every bit as nutritious as locally grown feedstuffs. And the animals eating it not only thrived but gained more than animals eating locally grown feed.

This is good news to Virginia's apple growers, who annually produce several thousand tons of pomace in processing apples for cider. At one time, a market for apple pomace existed in the preserve industry, which extracted pectin for jams and jellies. But this market has shifted to citrus. Foreseeing a use for pomace in nearby cattle feeding, researchers set up feeding tests to see how apple pomace compared with locally grown roughage for wintering cattle.

Animal husbandman B. M. Priode, of ARS, and M. J. Burris, of the State station (now with ARS), fed two types of apple pomace to cattle having access to sparse winter forage. One type was wet, containing 70 percent moisture. The other was dry, derived from the wet pomace by partial dehydration with steam heat to a moisture content of about



DRIED pomace (right) pours into 100-pound sack to be made ready for marketing. The huge, slowly-revolving, steam-heated drier is capable of drying 800 pounds of wet pomace an hour.

4 percent. The wet pomace was stored in a covered shed with no packing or preservative. Even under these conditions, the sugar-rich pomace remained nutritious, palatable, and unspoiled.

Unbred Shorthorn yearling heifers gained 115 pounds in 106 days—1.09 pounds daily—on self-fed dry apple pomace and a pound of cottonseed cake daily. For comparison, a sorgo-Sudangrass-soybean silage and .75 pound of cottonseed cake were fed per day to some other test heifers. They gained only 32 pounds, or .3 pound daily.

Cows consume more dry matter daily and gain faster

Animals on apple pomace ate 12.3 pounds of the byproduct daily, while the other heifers ate 43.7 pounds of the mixed silage. The animals on apple pomace ate an average of a pound more dry matter daily than those fed silage, accounting for part of the greater gain.

Heifers within each group gained uniformly, showing that competition for feed was low under self-feeding. Animals finished the test in much better condition on apple pomace than on mixed silage.

Pregnant cows were also fed apple pomace, but in fixed amounts. The pomace was fed to the animals with cottonseed cake and hay, or cottonseed cake alone. This gave as good or better results than mixed alfalfa-barley silage with cottonseed cake and hay or cottonseed alone.

All pregnant cows lost weight during tests as a result of calving, suckling, and use of wintering rations, but lost about the same (and their calves gained about the same) as groups fed other roughage.

Animals stayed thrifty despite weight losses. In each group on limited rations, some cows lost much more weight than others. The scientists think this was due to competition for the limited feed supply resulting from natural variations in aggressiveness among animals.

There was no evidence of toxicity in any of the pomace rations. But processors should be alert against hardware and foreign materials.

Researchers feel that the results obtained in this series of tests could also be applied in planning various dry-lot feeding operations.★



WET POMACE is stored easily under practical farm conditions just by dumping on pasture with no protection or preservative. There's practically no spoilage.

How serious is

PESTICIDE

■ OCCASIONAL BUT EXPENSIVE livestock poisoning by insecticides and herbicides has led USDA to study and develop some guides in dealing with this hard-to-diagnose type of ailment.

The newer chemicals are a boon to agriculture. Most of them are used on crops intended for livestock feed and can be so used safely. But poisoning can occur when animals are allowed to eat overtreated plants.

The *chlorinated hydrocarbon* insecticides are an example. They include the well-known and widely used DDT, TDE, methoxychlor, benzene hexachlor, isodrin, and endrin. These act primarily on the central nervous system—produce many symptoms from severe depression to violent convulsions and death by respiratory paralysis. In autopsies on mildly poisoned animals, the liver, kidneys, and sometimes the brain were found damaged. Surprisingly few such symptoms were found in acute poisoning.

Symptoms are important

Diagnosis of poisoning by the chlorinated hydrocarbons should be made only after thorough study of the history, symptoms, length of exposure, and lesions. Veterinarian R. D. Radeleff, of the ARS entomology research station, Kerrville, Texas, found this is necessary. That's because fully a third of the test autopsies failed to reflect the ailment, even where toxic symptoms were severe.

In making an autopsy diagnosis of suspected chronic poisoning, it's better to analyze the stomach contents rather than the tissues, for excessive amounts of poisons. Or if the animal has been sprayed, it's better to analyze the hair rather than the

POISONING OF STOCK?



Such occasional toxicities are difficult to diagnose and even when identified may mask more serious disorders

tissues. The animal may have accommodated itself to chronic buildup of poisons in the tissues but may actually be suffering from serious disorders such as rabies, pseudo-rabies, encephalitis, and salt poisoning.

Poisoning not always serious

Animals that show clearcut symptoms of poisoning by chlorinated hydrocarbons will usually recover completely if provided a quieting agent, soothing environment, good nursing care, and fresh, uncontaminated feed.

The *organic phosphorus compounds* are closely allied to the nerve gases developed for chemical warfare. These compounds include parathion, methyl parathion, malathion, Dipterex, chlorothion, Guthion, and others. They act primarily by adversely affecting the animal's nervous system. Animals so poisoned breathe with difficulty, slobber, and stiffen. Spontaneous recoveries are common if the poisoning isn't severe or if recovery isn't interrupted. Autopsies on poisoned animals show only some swelling or congestion of the lungs.

Atropine sulfate is a good antidote for organic-phosphorus poisoning. But it must be given in large doses—about one-fourth intravenously and the rest subcutaneously or intramuscularly. Recently, 2-PAM (2-pyramidyl aldoxime methiodide)—pref-

erably administered with atropine sulfate—was found to be good in parathion and diazinon poisoning.

Amount of insecticide applied to the crop is as important as toxicity in evaluating the chemical's dangers. Some highly toxic insecticides are safe because they are used in such small quantities on crops that it's almost impossible for animals to get enough to be poisoned. But some of the less toxic compounds become dangerous because of the much greater quantities used on crops. Important, too, is the size of the chemical particles. The larger the particles in the emulsions, the greater the deposits on an animal's hair.

Many farmers don't understand the effects of concentration and particle size on animals. Plant chemicals generally deposit more toxicants than do livestock preparations. Even though pesticides are properly manufactured, they may be misused. Plant chemicals often are used on animals. This has led to great livestock loss.

Herbicides not big problem

Herbicides have rarely been known to poison livestock despite claims to the contrary, according to Radeleff. The fact that herbicides are used to kill foliage limits the palatability of the treated plants. The only danger lies in consumption of freshly treated plants. And this can be

avoided by removing livestock from the treated area for 1 or 2 weeks at most. The large dosages of these compounds required to poison also limits the dangers of their use.

Pentachlorophenol—used to defoliate cotton and to preserve wood—was found by Radeleff to be lethal for calves up to a year old at 100 milligrams per kilogram of live body weight and mildly toxic at 25 mg. per kg. Sheep were killed by 200 mg. per kg., recovered from 100 mg. per kg., suffered mildly from 25 mg. per kg. Animals aren't apt to eat much.

Water herbicides are studied

Light applications of the algicide Delrad in ponds weren't harmful to cattle or sheep when they drank water containing 100 parts of the chemical per million. Cattle showed severe poisoning at doses of 250 mg. per kg.; young calves were severely affected by 150 mg. per kg.; and sheep were affected by 500 mg. per kg.

Work elsewhere has shown that 2,4-D and 2,4,5-T (common weed-killers) and their derivatives aren't very toxic. Cattle, sheep, cows, and swine were pastured under test on foliage treated at higher than normal rates with no harmful effects.

The toxicity of arsenical compounds is well established. A few are still used and doubtless will continue in use for specialized work. ☆

REQUIREMENTS FOR AMINO ACIDS

■ THE IMPORTANCE OF PROTEIN in human diets has long been known, but body needs for the individual essential amino acids that make up the various proteins have only recently been measured. It is especially necessary to know body requirements when diets are limited as they are in illness or when food supply is short.

The need for the amino acid lysine and the amount of methionine required with varying amounts of cystine have now been determined. This was done at the University of Wisconsin under contract with the USDA Institute of Home Economics.

This work extends contract research at the Universities of California and Nebraska (AGR. RES., July 1956, p. 11). They established young women's requirements for threonine, valine, tryptophan, phenylalanine, leu-

cine, and isoleucine. They also determined requirements for methionine when 0.1 and 2.0 grams of cystine were present. These amino acids (except for cystine) are "essential"—must be supplied in food every day.

To determine the lysine requirement, Wisconsin researchers used comparable methods and fed healthy women a semisynthetic diet containing all nutrients, except lysine, known to be needed by humans. The lysine was fed separately at different levels.

The women differed in their need for lysine as shown by their nitrogen balances. When the women did not get enough of the amino acid, they excreted more nitrogen than they consumed. This indicated they were using their own tissues to supply their needs for lysine and excreting the nitrogen released in the breakdown.

The level of lysine intake that gave nitrogen balance was considered to be the minimum requirement.

From the tests, investigators concluded that a daily intake of 0.4 to 0.5 gram is enough for most people. There seems to be little danger of a deficiency of this amino acid, since the average American diet supplies about 5.2 grams of lysine a day.

There was no relationship between the lysine requirement and height, weight, body-surface area, age, or even sex, since women's requirements were about the same as those for young men who were studied earlier.

The nitrogen-balance technique was used also to determine the requirement for methionine when cystine was given at levels ranging from 0.01 to 0.50 gram. Cystine can replace much of the methionine, but the diet must contain some of the latter if the body is to be adequately nourished.

The experiments showed that with an abundance of cystine (0.5 gram) in the diet, methionine requirements ranged from 0.15 to 0.30 gram. ☆

NEW GUIDE TO GOOD DIETS

■ A FRESH APPROACH BY USDA researchers to the problem of selecting an adequate diet has resulted in a new Daily Food Guide based on four broad food groups. The minimum

number of servings recommended for each group will supply most of a day's essential nutrients and about half the calories needed by the average adult. Additional nutrients and calories will come from extra servings and from fats and sugars ordinarily used with foods in the four basic groups.

Nutrition analysts Louise Page and Esther F. Phipard, in ARS Institute of Home Economics, used findings from food consumption surveys as a guide to nutrients needing emphasis.

The surveys show that calcium and vitamin C are the nutrients most likely to be below the National Research Council's recommended allowances. Some diets are also short in vitamin A, riboflavin, and thiamine. The surveys showed also the

kinds and quantities of foods that people buy and eat. The commonly used foods that contain important nutrients, including those apt to be low, fall into four broad groups. These groups were used by the researchers as the basis for the new food plan.

Food groups with servings and the nutrients they contribute are:

Milk, cheese, and ice cream. Two servings for adults, more for children, pregnant women and nursing mothers. Milk is our leading source of calcium and contains high quality protein, riboflavin, vitamin A, and many other essential nutrients.

Fruits and vegetables. Four servings. This group is valuable for minerals and vitamins. One serving of a vitamin C-rich item such as citrus

food for fitness A DAILY FOOD GUIDE

MILK, CHEESE
2 or more servings
(more for children)

**MEAT, FISH,
EGGS**
2 or more servings

**VEGETABLES,
FRUITS**
4 or more servings

**BREAD,
CEREALS**
4 or more
servings

and other foods
as needed for complete
and satisfying meals

is needed daily. One serving every other day of a dark green or deep yellow vegetable or fruit is needed for its vitamin A contribution.

Meat, fish, eggs, dry beans and peas, and nuts. Two servings. These protein foods supply iron, thiamine, riboflavin, and niacin.

Bread and cereals. Four servings of enriched, whole-grain, or restored products of rice, oats, corn, and wheat. These include baked goods, cereals, grits, macaroni, spaghetti, and noodles. They furnish worthwhile amounts of protein, iron, several B vitamins, and food energy.

The plan is explained in Leaflet 424, "Food for Fitness, a Daily Food Guide," available from USDA Office of Information, Washington 25, D. C. Teachers can get a colored, wall-size copy of chart on page 6 and Home Economics Research Report 3, "Essentials of an Adequate Diet." ☆

THERE'S A FLAW IN OUR TESTING OF FROZEN FOODS

■ BACTERIA COMMONLY OCCUR in foods, and wholesomeness largely depends on the number present. But in our testing of foods to learn whether they are contaminated—and if so, how much—we inadvertently destroy many bacteria before we have a chance to count them.

USDA research on precooked and frozen foods has shown ways to preserve a sample's bacteria long enough to count them and find just how wholesome the food is.

ARS bacteriologists R. P. Straka and J. L. Stokes, of the Western Utilization Research and Development Division, Albany, Calif., found that commonly used diluting agents such as tap water, physiologic saline solution, and distilled and phosphate-buffered distilled water cause fast and extensive destruction of bacteria.

For instance, research showed that in food samples treated with distilled water, 40 to 60 percent of the aerobic sporeformers, pseudomonads, and other common inhabitants of food died within 20 minutes, 90 percent within an hour. In similar tests with saline water and phosphate-buffered distilled water, from 20 to 30 percent died within 20 minutes, 80 percent within an hour.

Adding nutrient to diluent improves test

Researchers found that these losses could be avoided by using diluents containing complex protein nutrient substances—peptone and yeast extract, or mixtures of amino acids and even single amino acids.

As little as 0.1 percent was enough to give full protection to bacteria for at least an hour, provided the solution wasn't brought down below pH 6 by the food sample. This period of time is long enough to make it possible to count all bacteria accurately.

Use of a nutrient solution such as peptone would seem to encourage bacterial growth. Tests showed, however, that such growth occurred only after about two hours.



Yeast extract, casein hydrolyzate, glutamic acid, and glycine also protect bacteria long enough so they can be counted. Ammonium sulfate may give some protection. Glucose and dextrin aren't very effective, but sucrose seems to give some protection.

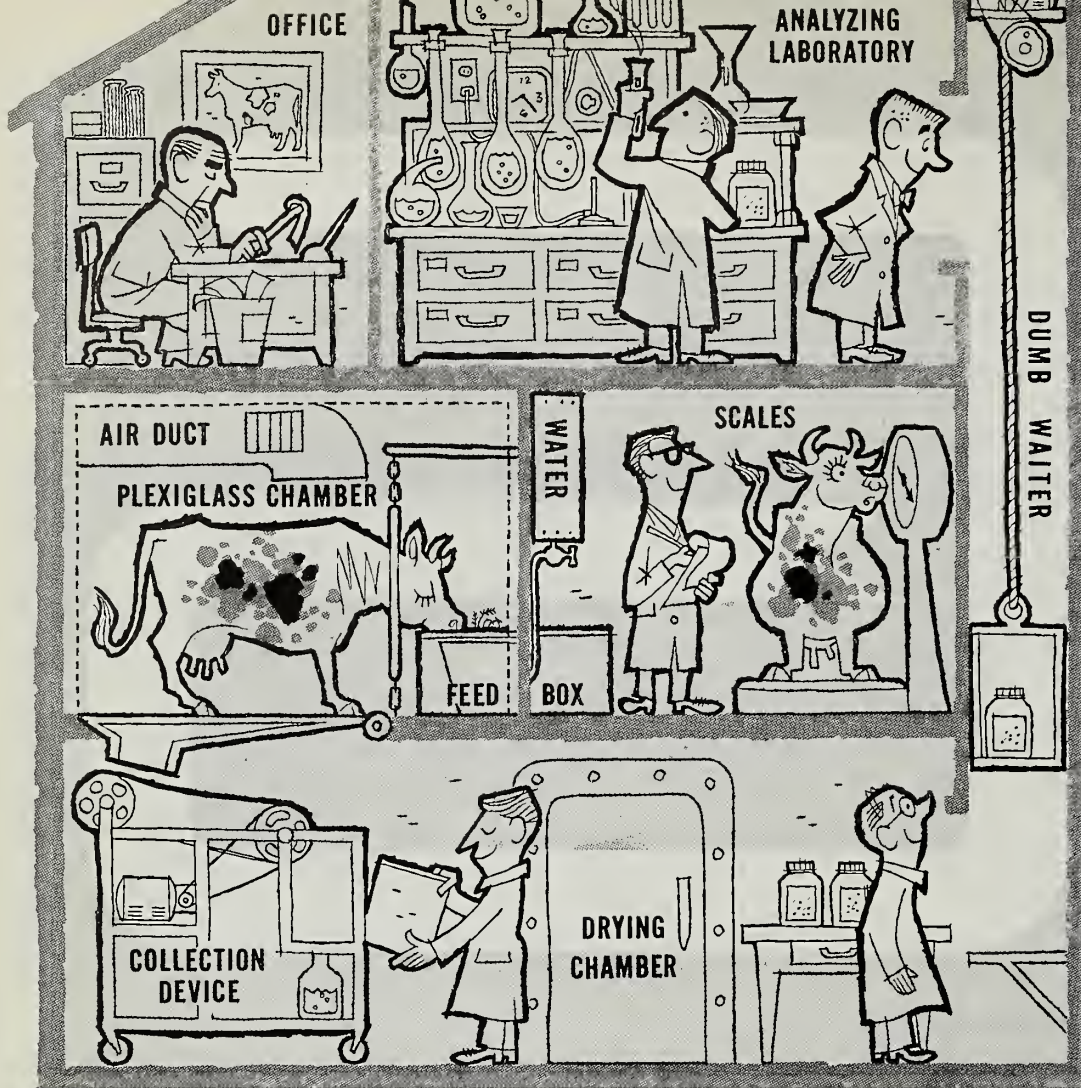
Extent of error varies in different samples

Degree of error in counting will vary with the number of sensitive bacterial cells present, the duration of their contact with water, and size of the initial bacterial population. Frequently, food with few bacteria shows smaller losses than food with many bacteria.

Not all types of bacteria die rapidly when placed in tap or saline water; some survive for hours and even days. But the more common food bacteria die quickly.

Reasons for the marked sensitivity of some bacteria and the resistance of others to destruction in water and saline solution aren't known. Nor is it known definitely how peptone and related organic nitrogenous substances protect the sensitive bacteria. It will take further investigations to provide the explanation.

Bacterial-contamination tests are usually made by macerating and diluting a sample. Then the food suspension is mixed with nutrient agar in plating dishes and incubated. Each living organism forms a colony that can be counted; from this count, the number of organisms in the original sample is calculated. ☆



SAMPLES of the different kinds of feed are placed in grinder by aide Herbert Righter (right). Each variety is stored in a jar.



MOVEMENTS of the cow are tracked by a photoelectric cell and tabulated on a recorder automatically. Above, W.

P. Flatt, the dairy nutritionist in charge, checks one of the recorders.

APPARATUS to collect excreta is kept in the basement beneath cow chambers. Righter (right) washes the roller to get ready for next experiment. Urine goes into jugs.

LOOKING IN ON COWS

Ingenious equipment and instrumentation will help us learn some of the long-needed fundamental facts about a cow's energy use

■ WHAT PORTION OF a cow's feed goes to milk production will be determined at a new USDA laboratory—the largest and most automatic of its kind to be found in the world.

The energy-metabolism laboratory, as it is called, was developed by remodeling and equipping an existing building located at the Agricultural Research Center, Beltsville, Md.

In uniquely equipped and instrumented airtight quarters, as many as six cows at a time can be studied under controlled conditions. The cows' every action will be recorded automatically, and their feed intake and their output will be analyzed.

Six individual compartments with walls of acrylic plastic are on the first floor of the building. Each compartment is 10 feet long, 5½ feet wide, and 7 feet high and accommodates 1 animal. The second floor houses laboratories. And the basement contains excreta-collection apparatus and a drying room. The self-sufficient building will also have a standby generator to provide for electricity and air conditioning at all times.

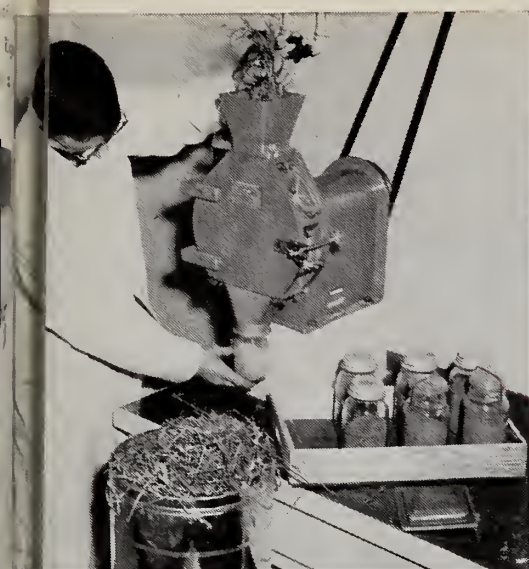
Automation makes study feasible

Aided by these elaborate facilities, ARS dairy nutritionist W. P. Flatt, chemist Peter Van Soest, and four

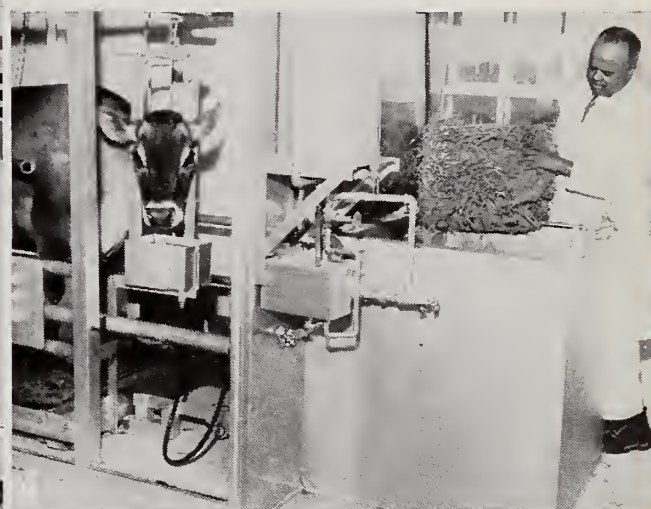
laboratory technicians will thus delve into and expose cows' innermost secrets as to energy intake and uses. Studies such as this have been restricted in the past by the enormous manpower requirements; these included manual attention to the animals for 24 hours a day.

Identical twin cows are now being studied in the airtight plastic compartments to determine energy utilization of forages. Everything the animals consume—the food they eat, the water they drink, the air they breathe—as well as everything they excrete is measured and recorded.

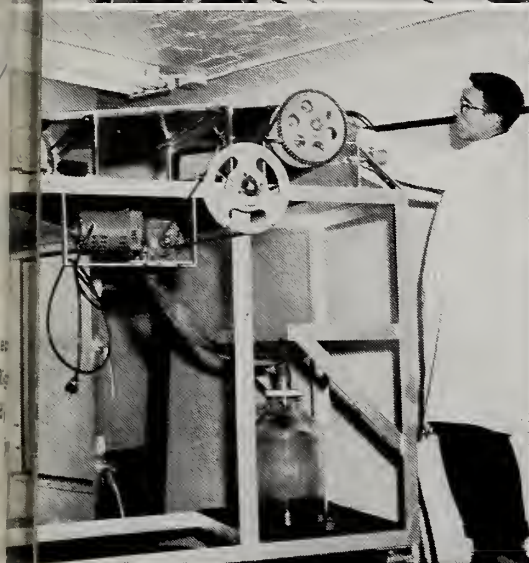
When dairy husbandmen learn the amount of heat a cow produces and the amount of food she digests and metabolizes to maintain her body, the



JARS OF FEED are sent to the laboratory for analysis. Righter (left) prepares to send samples by dumbwaiter to the top floor.



FEED is put inside the bin by aide J. L. Brown (above). The lid is closed, air inside the compartment is measured, and the bin is slid inside chamber.



CHEMICAL analyses are made (left) by Flatt. He is determining the crude fiber content of samples of feeds used in the tests.

METABOLISM

balance will represent the food that produces milk or body gain. Different rations are fed to compare the nutritive value of forages. Different animals are used to learn the effect of environment and genetics. Beef cattle may be studied here later.

Cows are made to feel at home

Animals will spend 2 weeks in the chambers for preliminary study and to get adjusted to feed levels to be used later. This will also help get them used to their environment so that they will act normally.

The critical digestion and metabolism tests will be made during the following 10-day period when feed, respiratory, and gas analyses will be made. Animals will be exercised out-

side the chambers during feed studies, but confined to airtight chambers for 2 of the 10 days during the time of making respiratory gas analyses.

All movements are recorded by photoelectric cells and transmitted to tabulators. The number of times and the length of time each animal moves, lies, and stands are recorded. Bars extending from the sides keep the animals, whether calves or cows, centered on movable platforms.

Hay, silage, and pasture forages will be fed to the animals alone and with concentrates. Then nutritional value of individual feeds and complete rations will be determined.

The laboratory is equipped to analyze feeds, excreta, and respiratory gases. Studies are aimed at devising

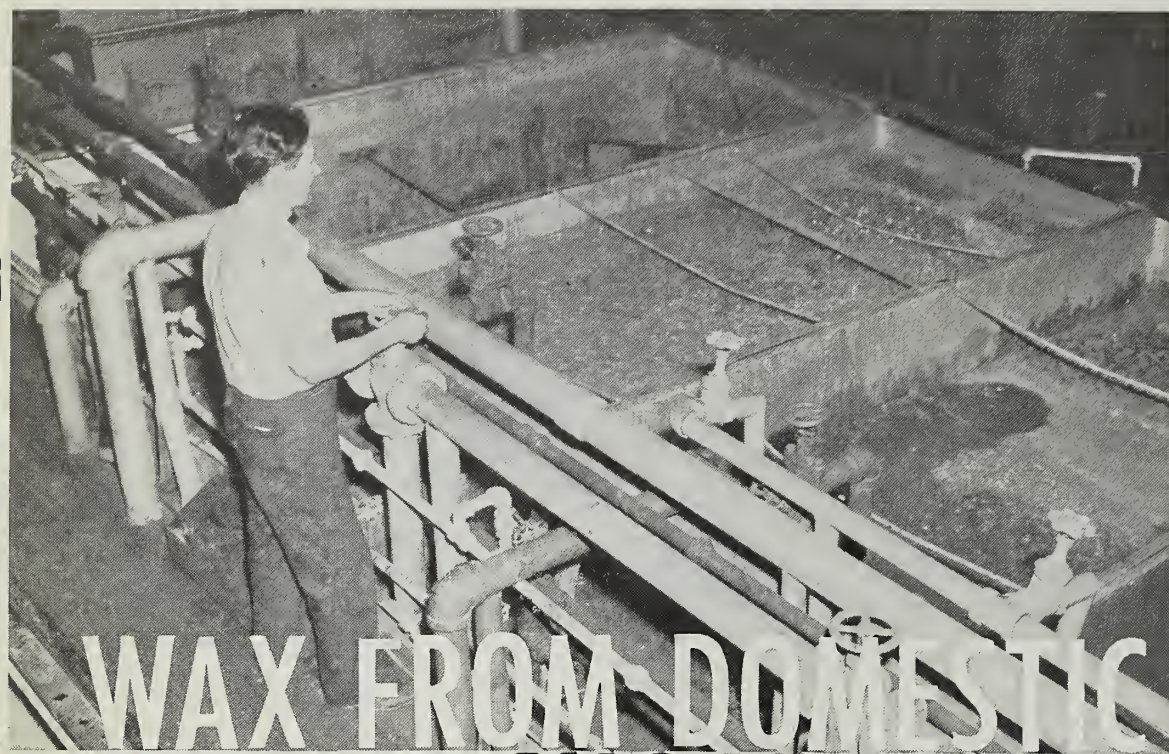
better analytical methods—especially how to separate out more refined carbohydrate fractions that can be analyzed precisely as to chemical composition. With that, we could more accurately evaluate feeds.

The crude fiber, fat, protein, nitrogen-free extract, and carbon are determined. Vacuum ovens are used to learn how much moisture is in the sample. Furnaces burn feed to find mineral content. Calories are determined in a bomb calorimeter.

Exhaust air is also tested

Respiratory gas samples are analyzed for carbon dioxide, oxygen, and methane using a modern gas chromatograph, which completes an analysis in one-tenth the usual time.

Rumen fluids and blood are analyzed for the presence as well as amounts of fatty acids and ketones. Up-to-date equipment reduces labor and time required for laboratory work and metabolism studies. ☆



SUGARCANE MUD is impure residue left after the cane juice is settled and drawn off in these large vats.

WAX FROM DOMESTIC SUGARCANE

Oil-extraction process may enable us to compete with foreign waxes

■ CRUDE WAX HAS BEEN successfully obtained from domestic sugarcane through a low-cost, efficient, and compact process originally developed for another purpose. The filtration-extraction process—as it's called—was recently developed by USDA researchers to extract oil from oilseeds (AGR. RES., May 1956, p. 5).

All the sugarcane wax used in this country is imported from Cuba as a crude wax and shipped to Gramercy, La., where it's refined by a large commercial wax manufacturer. Our domestic sugarcane is a potential source of about 7 million pounds of crude wax yearly, which would yield about 60 percent in usable hard wax.

Early research at the ARS Southern Utilization Research and Development Division, New Orleans, La., showed in detail many of the physical and chemical properties of various sugarcane waxes. Studies on processing

methods and costs led to our present methods of extracting and refining wax. We've gotten many commercially useful products in addition to wax from research on the many by-products of sugarcane wax extraction, such as the fatty material that is a source of crystalline alcohols, fatty and waxy acids, and glycerine.

Our wax might replace imports

The successful and practical laboratory extraction of this fine wax from our own sugarcane means that we might be able to replace or supplement the high-priced imported carnauba, ouricuri, and candelilla waxes. We would also have a domestic source of sugarcane wax to use in carbon paper (one of its main uses), and in floor waxes, shoe polishes, printing inks, and finishing materials.

Crude wax is originally present as a coating on sugarcane stalks. After

the cane is processed, the wax is found as a constituent of the sugarcane mud—the heavy, impure residues from cane juice. In Cuba, crude wax is recovered from the mud by a continuous counter-current solvent-extraction method using heptane as the solvent. Mud moves in one direction, passes through a heptane solution moving in opposite direction.

Foreign technique unsuited here

This method isn't satisfactory in our country for several reasons. It's inefficient, utilizes heavy, centrally located equipment, and produces large solvent losses. Despite these facts, it's still possible to operate economically with this method in Cuba. The production season is long there and the closely grouped plantations serve large sugar mills. Plantations in the United States, however, are distributed widely and serve many small mills. Not enough sugarcane mud is produced at any one mill to warrant a wax-extracting installation. Thus, it would be necessary to haul the mud to a centrally located plant. This would be uneconomical. Furthermore, such a large plant would require heavy capitalization for use only during the milling season.

These limitations of the cumbersome counter-current solvent-extraction method led ARS engineers Joseph Pominski, J. J. Spadaro, and H. L. E. Vix of the Southern laboratory to successfully try the more efficient filtration-extraction method.

Cheap method more efficient

They slurried the wet sugarcane mud in tests with hot heptane, then extracted the wax by a combination filtration, evaporation, and stripping operation. Extraction efficiency ran 83 to 85 percent, compared with the 70 percent normally obtained for commercial extraction in Cuba.

These small-scale experiments indicate need for large-scale work. ☆

BREAK ON GRAPE BREEDING

Producing fertile hybrids opens way to bring together bunch type and muscadine

■ SOME LONG-STERILE grape hybrids have been made fertile by a USDA scientist. He did it with a drug that doubled the chromosomes—inheritor bodies in the cell nucleus.

Grape breeders have sought this breakthrough half a century or more.

Southern muscadine grapes (*Vitis rotundifolia*) are vigorous, flavorful, and resistant or quite tolerant to most serious grape troubles (black rot, mildew, anthracnose, virus diseases; berry moth, phylloxera, leaf hopper; nematodes). But muscadines need the big cluster of bunch grapes. In turn, bunch grapes (such species as *V. vinifera* and *V. labrusca*) need the muscadine's strong qualities.

Now the way is open to try crosses that will bring the two together.

This has been difficult, probably because of the difference in chromosome numbers: cells of bunch grapes contain 38 chromosomes (2 sets of 19), whereas muscadines have 40 (2 sets of 20). The few hybrids over the years have been nearly sterile.

That was true of hybrids N. C. 6-15 and N. C. 6-16, produced at the North Carolina Agricultural Experiment Station in 1917. They contained 39 chromosomes (19 plus 20).

Drug doubles chromosomes

In 1955, ARS cytologist Haig Dermen, at the Agricultural Research Center, Beltsville, Md., treated an N. C. 6-16 plant with colchicine. (See AGR. RES., October 1953, p. 3; Decem-

ber 1955, p. 13.) This caused one branch to develop with double the usual number of chromosomes in the internal cells; that is, the tissues were changed from diploid (2 sets of chromosomes, 39 in all) to tetraploid (4 sets, a total of 78).

This branch bore a bunch of grapes, and from the seeds Dermen grew 42 all-tetraploid seedlings.

Thus, for the first time, we have full fertility in crosses such as this.

Diverse stock is necessary

But this doesn't finish the job at all. The 42 seedlings seem exactly alike genetically and the same as the tetraploid mother branch. Breeders must have genetically diverse stock in order to get crosses that give us an interchange of desirable characters. Then we would be able to make selections and develop superior plants for different uses and areas.

Dermen tried a shortcut. He had previously produced single-species tetraploids of both muscadine and bunch type. He now crossed these in hopes of producing fertile hybrids directly without further use of the drug.

TREATMENT with drug colchicine made this change by doubling chromosomes in a nearly sterile hybrid of bunch grape (*V. vinifera*) and southern muscadine (*V. rotundifolia*). Small bunch of grapes grew on branch that was diploid (two sets of chromosomes in cells). Large bunch grew on branch that became tetraploid (four sets) after treatment.



But no fruit developed—perhaps in part because of the polyploidy, or because of inherent strong incompatibility of the breeding material.

He was surprisingly successful, however, in producing new diploid crosses of the two types. Perfect-flowered muscadines were used as the male parents, self-sterile bunch grapes Lindley, U. S. 519-28, and Franklin as the female. Lindley produced no seeds, but U. S. 519-28 yielded a few and Franklin gave a heavy set.

Assuming that the diploid hybrid seedlings from these crosses would be sterile, Dermen immediately treated 75 of the most vigorous young plants with colchicine. A change to tetraploidy appears to have been made in about 2 dozen. Similar results were obtained with N. C. 6-15 plants.

Useful crosses anticipated

So we have a start. It should be possible to cross fertile tetraploid hybrids of diverse chromosomal make-up and bring about the segregation of characters that we need.

Developing the potentialities calls for widespread research effort. ☆

DUAL-PURPOSE

APRICOTS

TAP EXTRA MARKET



EARLIRIL (rear tree) like Blenril, is vigorous, productive, winter hardy. Commercial variety Tilton (front above) winter killed. Fruit from test tree (left) shows attractiveness, appeal.

■ TWO HARDY NEW APRICOT varieties good for eating and processing have been developed for the Pacific Northwest by USDA-State research.

Neither Wenatchee nor Tilton, top varieties there, meets both needs.

Earliril and Blenril, the new dual-purpose apricots, should help to stabilize the price of fresh fruit during the full-crop years. And the new varieties offer one more crop for processors needing to diversify.

Researchers of the ARS Western Utilization Research and Development Division and the Washington Agricultural Experiment Station developed these two new varieties. They originated in 1947 in a planting of about 1,650 seedlings at the Irrigation Experiment Station at Prosser. Cooperative Federal-State stone-fruit breeding was started in 1949. First selection among the seedlings was in 1950, following winter temperature of -20° F. From nine winter-hardy selections with superior fruit characteristics, Earliril and Blenril made their appearance in 1957.

Both varieties are strong, vigorous, and bear even-ripening medium-sized, high-quality freestone fruit. Both are as attractive as Riland and have the firmness and fine texture common to later maturing varieties. The new apricots are apparently free of latent ring-pox virus.

Both varieties seem especially well adapted to the fresh market because they are early, attractive, and high in quality. Also, limited tests suggest they ship very well. Although smaller than Wenatchee, either variety should be competitive with it on distant fresh markets.

Canning tests during five seasons showed both Blenril and Earliril are flavorful and have firm and tender flesh with fine texture. They held shape well. Unpeeled, they're slightly less attractive than Blenheim and Tilton, due to dull skins. So it's desirable to peel the new varieties for canning. Both of them made satisfactory peeled products. Earliril is somewhat more attractive and less fibrous than Blenril.

Blenril is self-fertile, but a pollinating variety is desirable with Earliril. Blenril or any common apricot will pollinate Earliril. ☆

How To Train a

Low heading causes poor crotch formation, doesn't raise the yield of fruit

■ THE TRADITIONAL METHOD of heading peach trees—close to the ground with 3 or 4 leaders—does not necessarily increase the yield of fruit. Such heading does increase chances of poor crotch development.

This is the indication after 10 years of experiments (1947-57) by the Washington Agricultural Experiment Station in cooperation with USDA crops researchers at the Irrigation Experiment Station in Prosser.

Peach trees that had received no pruning, after initial heading back at planting, yielded significantly more fruit during the first crop in the orchard than pruned trees. After this, the difference evened out. By the tenth year, total yield for the life of the trees was about the same for all trees regardless of pruning methods.

Horticulturists J. H. Schultz and T. A. Merrill (who started the study) and E. L. Proebsting, all of the Washington station, and H. W. Fogle, of ARS, experimented with Elberta peaches. They trained the trees to show best heading height and choice of leaders for a strong framework and maximum early bearing surface.

Trees were headed at 18, 33, or 48 inches at planting. After initial heading back, 4 different pruning treatments were used to determine effects of the number of leaders retained and the time of selecting them. These were: (1) establishing leaders in



PEACH TREE

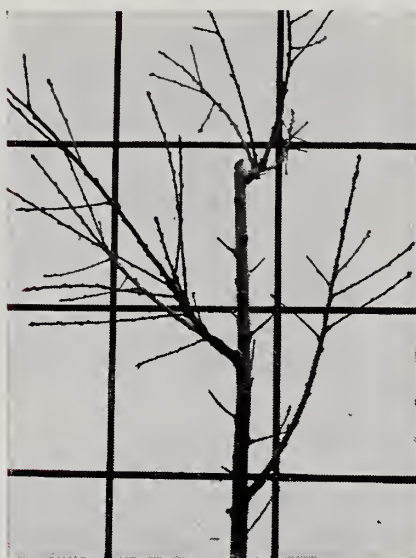
May after planting by gradually removing from the developing wood all but 3 chosen buds; (2) pruning initially in the dormant period after the first growing season to remove all but 3 selected leaders; (3) the same as "2" except retaining 6 leaders; and (4) no pruning until in bearing 5 years after planting.

Trees headed at 48 inches tended to die back during the first growing season and became equivalent to those headed at 33 inches. The higher heading provided more opportunity for vertical spacing of leaders. But trees headed at 18 inches almost invariably had vase-shaped crotches when 10 years old and appeared to be more likely to split under stress.

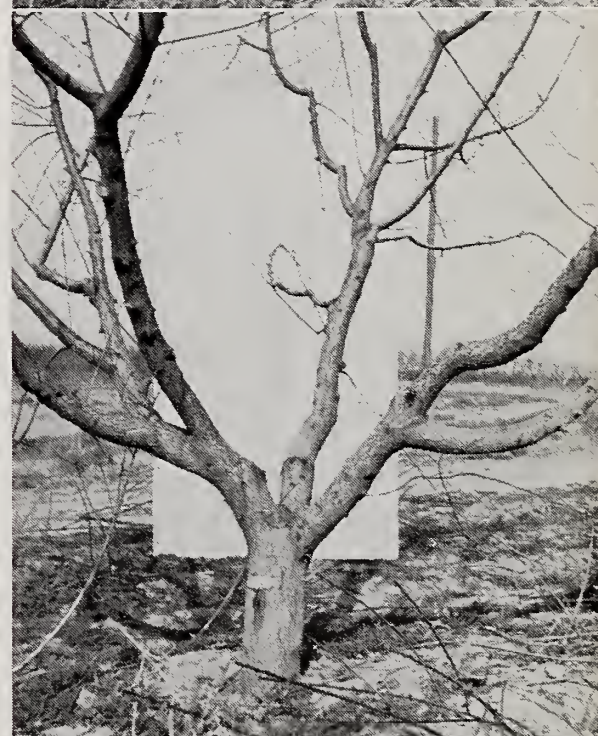
Moderately high heading, about 30 inches, provided an opportunity for satisfactory vertical spacing of leaders. No advantage of leaving more than four leaders could be discerned, based on observations of other orchards and these tests. After 10 years most trees had crowded out all but 3 or 4 leaders.

The researchers recognize that the development of a strong framework will be, in the long run, the most important function of early training. In the study there was little damage or breakage of limbs. Tests are being continued in order to evaluate the best methods of obtaining strong framework essential for peach trees. ☆

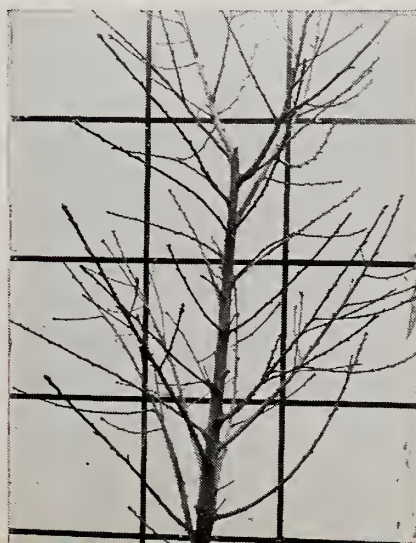
PEACH tree headed at 33 inches (below, after first year) had well-spaced frame and strong crotches at 10 years (right).



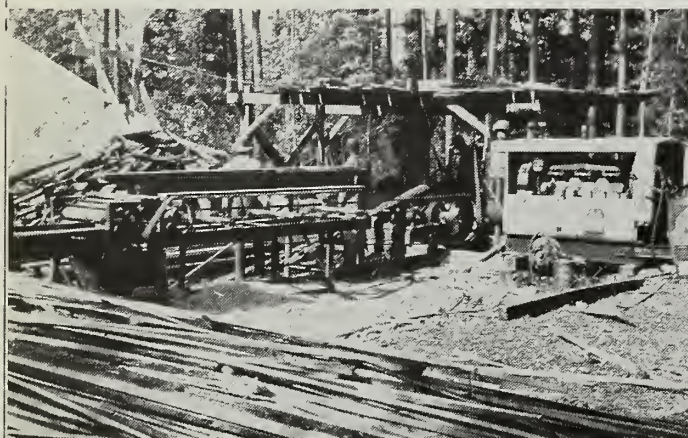
TREE headed at 18 inches had pronounced vase form after first season and showed crotch weakness after 10 years growth.



BUSHY tendencies showed up first season following 48-inch heading. By the tenth year, tree had good, strong frame.



SALVAGING SAWMILL RESIDUES



PORTABLE mills usually leave waste behind but this mill makes pulpable slabs and edgings.

HEAVY, costly automatic log barker is used by some mills to remove the bark from the pulp chips.

Milling wastes could add income, save 40 percent yearly in pulpwood cut

■ SALVAGING PULPABLE SLABS and edging from portable pine sawmills in the Southeast could be profitable for farmers and operators of sawmills and pulpmills, research by the USDA Forest Service has shown.

These residues once were burned at sawmills to produce steampower. But today gasoline or diesel fuels are used. When the mill is moved to another area, huge piles of slabs and edgings are left behind.

Landowners, often farmers, find the residue a nuisance. Some of this wood is sold or used by the family for fuel. Some is given away to neighbors. Decay eventually destroys the remainder, unless it is burned.

Sawmill residues originate as irregularly shaped pieces in a variety of widths, thicknesses, and lengths. In rough form, the average bark content ranges from 25 percent of volume for edgings to 35 percent for slabs. To prepare the residues for pulping, the bark must be reduced to 5 percent or less, and the wood converted to chips of rather uniform length in order that they will conform to the specifications of the purchaser.

To date the development of a slab-salvage program for pine has depended primarily on installation of expensive equipment for debarking and chipping. Such equipment is on hand at some of the larger sawmills. But little progress has been made in marketing residues of the



SMALL sawmills send slabs to concentration yards to weigh, debark, chip before sending to pulp mills.



BARK may also be removed from slabs with less expensive equipment either at sawmills or concentration yards.

numerous small pine mills, where three-fourths of the potential material is produced.

If a market were available and title to the residues were to remain with the landowner, he could increase his income. If title to residues goes to sawmill operators, landowners might price timber higher.

A. S. Todd, Jr., and W. C. Anderson of the Southeastern Forest Experiment Station, Asheville, N. C., studied 10 different methods of salvaging slabs and edgings from small sawmills to determine the most economical procedure under given conditions.

Sending rough residues to pulpmills for debarking and shipping is the least expensive way to salvage up to 190 cords per day. When larger volumes are required, supplemental railside yards could be set up to debark, chip, and ship the residues. The smallest economical railyard has a daily capacity of 25 to 30 cords. The same methods also would be best for hardwoods if a market were to develop for this kind of wood.

Landowners and sawmill and pulpmill operators can work together to encourage installation of required facilities and thus develop a market for slabs and edgings. Converting residues to pulp and paper should increase income of landowners and sawmill operators and enlarge the supply of material for the pulpmills.☆

Two States certified

Rhode Island and Pennsylvania have been declared modified-certified brucellosis free by USDA, the first such certifications this year.

This means that not more than 1 percent of the cattle in each State and not more than 5 percent of the herds therein have brucellosis.

Nine other States and Puerto Rico have been similarly certified. The other states are Connecticut, Delaware, Maine, Minnesota, New Hampshire, North Carolina, Vermont, Washington, and Wisconsin.

Aid to fertilizer study

The most profitable use of fertilizers can be determined with a USDA economic kit consisting of standard-yield curves and a table. The kit was developed by D. B. Ibach, ARS agricultural economist.

Use of the kit simplifies calculations usually required to determine the best use of fertilizer after experimental plots have been treated with various amounts of nutrients.

Yields are plotted vertically on graph paper coordinate with rates of application indicated horizontally. These plotted yields are placed over the different standard curves until the best fit is located. Then the curve is traced on the graph paper.

The maximum yield obtainable from adding fertilizer, and the most probable yield at any rate of application, can be read from the traced curve. Profitable use of fertilizer may be estimated with a few calculations and reference to the table.

The kit will be useful to professional workers for analyzing results of fertilizer rate experiments or field trials. The standard curves, repro-

duced on dimensionally stable material, together with instructions and an illustration, can be purchased for \$3 from the Division of Photography, in the Office of Information, USDA, Washington 25, D. C.

Brown seeds harmless

Brown seeds of the poisonous halogeton plant may not be to blame for spreading the weed on Western rangelands, in view of recent research.

All attempts to germinate the brown seeds failed in cooperative work by USDA and the Utah Agricultural Experiment Station. But the black seeds, which the halogeton plant also produces, were strongly viable and germinated very rapidly in tests.

ARS plant physiologist M. C. Williams, at the Utah station, doubts halogeton would survive under natural conditions if only brown seeds were produced. For example, in tests of 1953 samples, no viability remained in brown seeds, while 27 percent of the black seeds germinated.

This doesn't mean, though, that halogeton is no longer a danger. This weed already infests over 11½ million acres and is spreading at a rate of about a third of a million acres a year. Oxalate in the plants makes them poisonous to animals. Acreage thus made unsafe for grazing now constitutes more of an economic loss than the value of the sheep actually killed by eating the weed.

Sagebrush control

A potential gain of more than \$40 million could be realized by controlling sagebrush on the 24 million acres of western rangeland infested with this weed, according to USDA. Some 96 million acres are actually infested

with sagebrush but only 24 million are adapted to spraying.

ARS agronomist D. L. Klingman of the Agricultural Research Center, Beltsville, Md., estimated the potential gain through increased forage and livestock production. Such gains are dependent on improved management as well as brush control of *all* sagebrush land it would pay to treat.

Klingman's statement is backed up by cooperative Federal-State research on control of big sagebrush in Oregon and Wyoming. In these experiments, the value of forage was assumed to be \$10 a ton. Spraying costs were prorated over a 10-year period. The annual net gain would be \$1.68 per acre over weed-control cost. For 24 million acres, this gain would be more than \$40 million.

Range weed control might also offer these returns: \$16.5 million yearly for sand sagebrush control, \$10.5 million for mesquite control, and \$3.3



million for control of larkspur-sagebrush-rabbitbrush mixtures.

These profits take into account increased forage yields, cost of treatment, annual net gain per acre, and number of acres adapted to spraying.

Weed control indirectly results in better forages and ranges for the producer, fewer poisoning and injury dangers to livestock, greater water yields, and easier livestock management on weed and brush-free ranges.

Need identical-twin calves

USDA scientists want to buy several pairs of identical-twin beef calves (purebred, grade, or crossbred) for

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nutrition and breeding studies at the Agricultural Research Center, Beltsville, Md. Calves must be less than



5 months old, born after Dec. 1, 1957, and before June 30, 1958. Both heifers and bulls are needed.

To save on shipping cost, animals are sought within a radius of about 250 miles from Washington, D. C. It's hoped that calves can be found in Maryland, Virginia, West Virginia, and southeastern Pennsylvania.

Anyone willing to sell identical twin calves of above specifications should write to E. J. Warwick, Acting Chief, Beef Cattle Research Branch, Animal Husbandry Research Division, Agricultural Research Center, Beltsville, Md. An inspector will check the calves if desiring to purchase.

New Institute aide

Twice winner of the Borden Award for Nutrition Research, and an internationally recognized nutrition authority, Ruth M. Leverton is the new associate director of the USDA Institute of Home Economics.

Her experience includes teaching as well as research. She has been a Fulbright professor in the Philippines; a delegate to various international and United Nations meetings; and professor of nutrition at the University of Nebraska and director of

human-nutrition research at the experiment station there. From 1954 to 1957 she was assistant dean of home economics and assistant director of the experiment station in charge of home-economics research at the Oklahoma State University.

Miss Leverton will assist Hazel K. Stiebeling in directing home-economics research in the Institute.

A disease-resistant flax

A new rust- and wilt-resistant flax variety adapted to the North Central States has been released by USDA and the University of Minnesota.

The new flax—called Arny after the late Professor A. C. Arny of the University—is immune to prevalent flax-rust races. It also has a factor—not contained in other late flaxes—for resistance to other known rusts. And Arny is less susceptible to pasmo, a fungus disease of flax.

Arny, developed from a Crystal and Redson cross, has yielded high in tests. Oil quality is better and oil content as good as in some common varieties. Seed is available from approved growers for 1958 plantings in Minnesota, North and South Dakota, Iowa, and Wisconsin. USDA is *not* distributing any seed of this flax.

Pinkshipper tomato

A new wilt-resistant, pink-fleshed tomato, Pinkshipper, has been developed by USDA for fresh-market use, following 5 years of greenhouse

and field testing. Some seed is available this year from commercial seed sources, but *not* from USDA.

Pinkshipper is uniform and smooth. It averages about 2½ inches in diameter and weighs over 5 ounces. Medium-sized tomatoes are round; large ones are deep oblate. The skin is transparent, allowing the scarlet of the flesh to show through to give the fruit its deep pink color.

The new tomato is adapted to greenhouse or field culture. It will yield well on wilt-infested soil. It has been field-tested in the wilt-infested soil of southeastern Arkansas under actual commercial growing conditions by the Arkansas Agricultural Experiment Station.

Pinkshipper ripens in season with Marglobe. A crop grown from medium-sized transplants will be ready for picking in about 75 days. But in warm weather, the crop may ripen in 65 days. First harvests may be small, but growers who have tested Pinkshipper feel it will give a high per-



centage of marketable fruit for the duration of the growing season.

ARS plant pathologist W. S. Porte of the Agricultural Research Center, Beltsville, Md., developed the new tomato from a cross of Gulf State Market and Pan American varieties, outcrossed to a line derived from a Marvelosa and Marglobe cross.